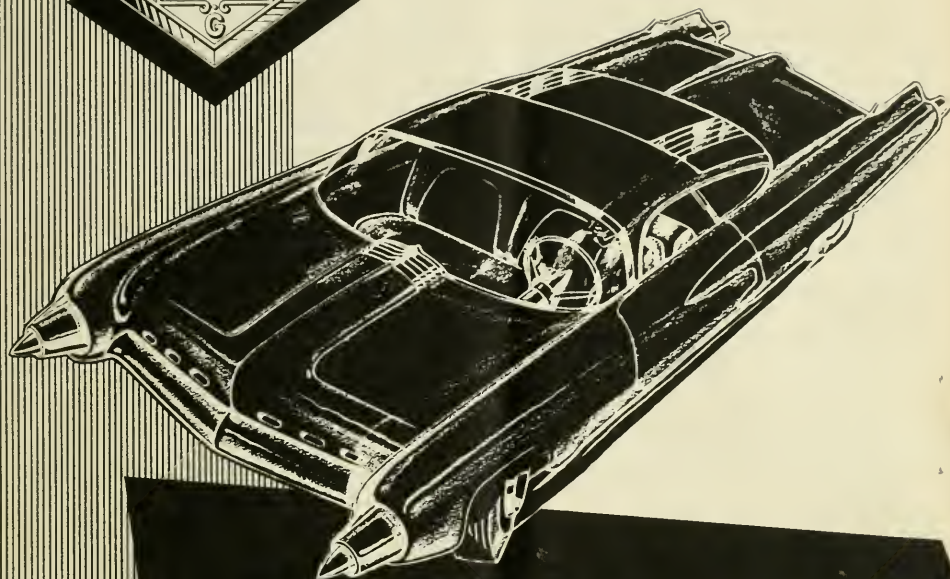
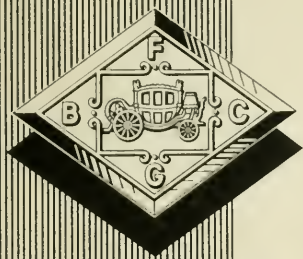


Ruth Sommer



DESIGNING MODELING BUILDING

a model automobile

FISHER BODY CRAFTSMAN'S GUILD

An organization for the development of craftsmanship
and creative ability among boys.

• LEARNING TO DESIGN A CAR

Don't let the word "design" scare you. Any one can learn to draw, *if he is willing to practice*—and designing is nothing more than drawing *with a purpose*. The fact that you never learned to draw doesn't mean you *can't*. The sketches on this and the three following pages give you the practice steps for drawing an automobile. Work at them for an hour or two every day for a week. You'll be surprised how much skill you gain in that short time. Keep on for two or three weeks, and you'll really have the "feel" of it. *Of course, you don't need to draw at all to build a model car for the Guild competition. You can shape your design in modeling clay—and that's a lot of fun.* (See the clay modeling instructions on Page 6.) The Guild competition offers you rewards big enough to call forth your very best effort. If you work, you'll win—valuable experience, to say the least—and, very possibly, one of the several hundred Guild awards. So, now, let's go! First, study carefully Drawings "A" and "B" (on the sheet inserted in this book). They give you measurements and other requirements. Then *practice* the following steps:

(A)

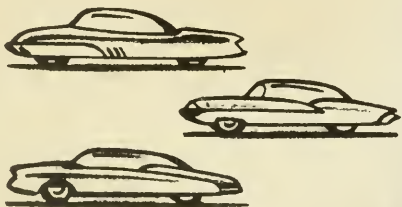
Trace a few present-day cars from a magazine.



This gives you the feel and proportions of car "form."

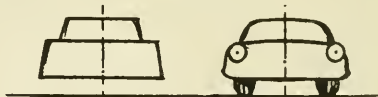
(B)

Try a few side views next. Do these free hand.



(C)

Direct front and rear view designing.



Block in

Add lights, wheels

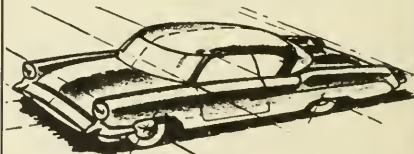


Grille design

Other details

(D)

"Perspectives" tell more.

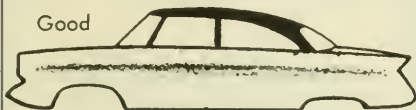


Make your design over a car from a catalog illustration.

E

You should strive for a light, graceful upper structure in your design.

Good

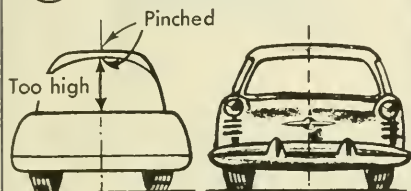


Too heavy



F

Rear views

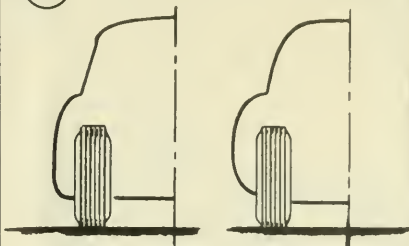


Poor proportion

Good proportion

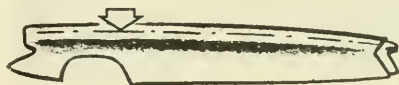
G

Design of "section" through car.



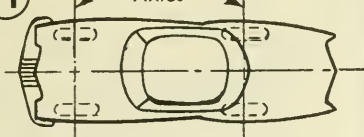
"Crisp" design of section through car will result in longer highlights and better streamlining. See drawing below.

Too "round." Highlights will be soft and short. Design will be more difficult to streamline.



H

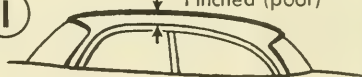
Axles



Plan view of your design is important.

I

Pinched (poor)



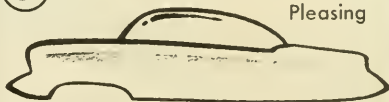
Good "space design"



Side view of upper structure proportions

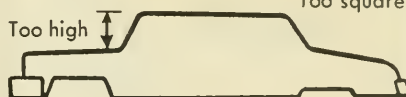
J

Pleasing



Too high

Too square

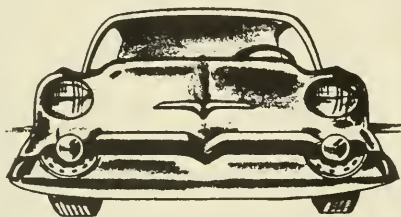
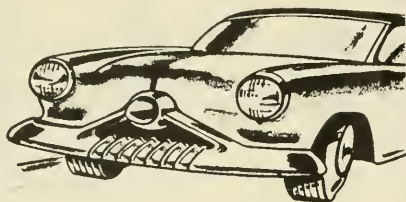


Outline of car

(K)

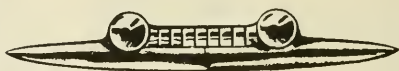
Front-end composition
or design

Work out design in "perspective"—
as well as head-on view.



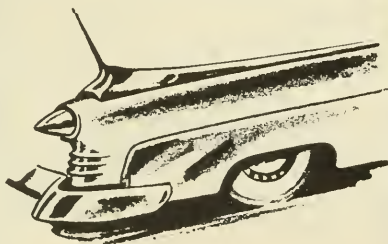
(L)

Front-end
theme "doodling"



(M)

Fender and tail-light
theme "doodling"

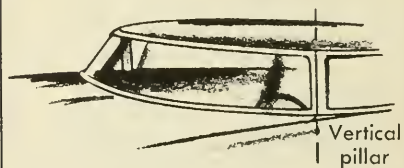


Cones and
bullet shapes
in perspective



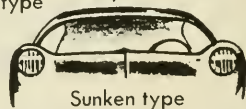
(N)

Study windshields



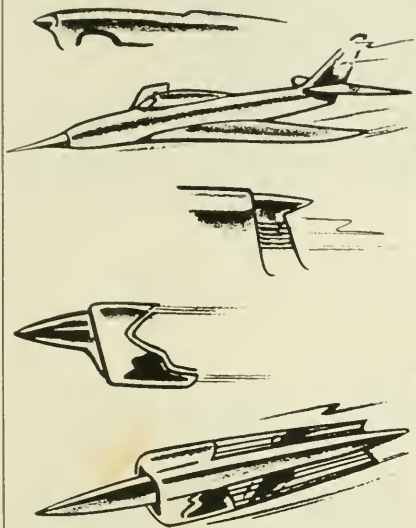
(O)

Study hoods



P

Line, form and texture suggest speed and graceful motion.



Q

Various types of ornamentation



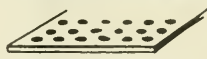
Windsplits



Grooved effect



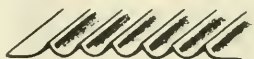
Raised fins



Perforated panels



Fine "egg-crate"

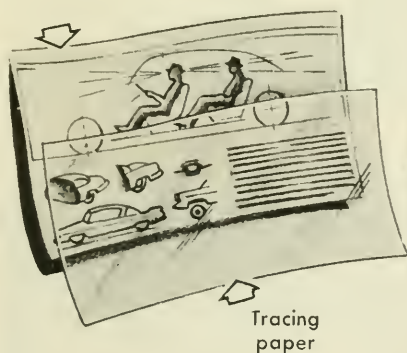


Windsplits
in groups



R

Use Drawing "A" (inserted as a loose sheet in this book) to develop side view of your car.

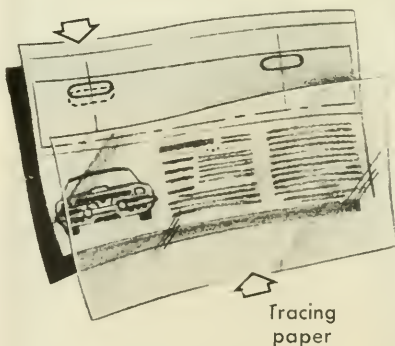


Tracing
paper

After careful study and "design thinking," you can work over Drawing "A," using a clean sheet of tracing paper on which to draw your design. Try many, keeping in mind the "hints" given you.

S

Use Drawing "B" (on other side of insert sheet) to develop plan view of your car.

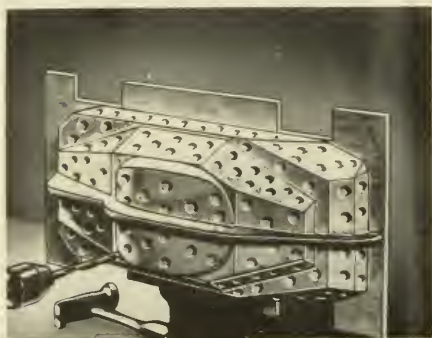


Tracing
paper

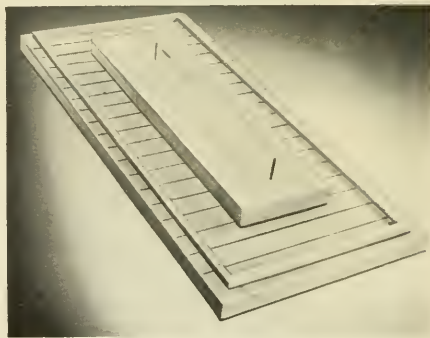
Plan view needs special study and attention to give design speed and beauty. Remember, this is highly important.

•HOW TO MAKE A CLAY MODEL

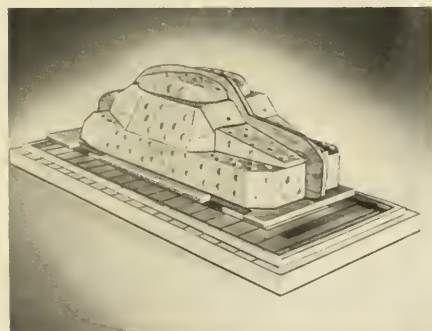
Be sure to make a clay model, as professional car designers do. You can change it easily as you get new ideas—and you will *NEED* it as a *pattern*, if you cast your model in plaster, or, for a wood model, to make templates as explained farther on. To buy modeling clay, write the Guild Technical Supervisor for a supplier's address. You can make your own clay by mixing: Powdered clay or whiting, 55 oz.—Cup grease, 28 oz.—Paraffin wax, 13 oz.—Rosin dissolved in turpentine, 1 oz. Melt together cup grease, paraffin wax and rosin solution. Then sift and mix in powdered clay. To save clay, make a wood form (armature), as shown in Photo 1, below. Attach a bottom board, as shown, to support clay on sides. Make this board at least 1 in. narrower and 1 in. shorter than model. Notch it so you can insert cardboard wheels, giving the "feel" of a real car. Armature is mounted on surface board (Photo 2). Dowels or headless nails, centered within guide strips around edges of surface board, slip into holes drilled in bottom of armature to position it while making clay model. This will permit insertion of a loose $\frac{3}{4}$ -in. block underneath armature to hold model at proper height for checking over-all appearance with cardboard wheels. Photo 2 shows block in place.



1. Drill holes in armature to anchor clay. Six pounds of clay will do. Solid clay model requires 20 pounds.



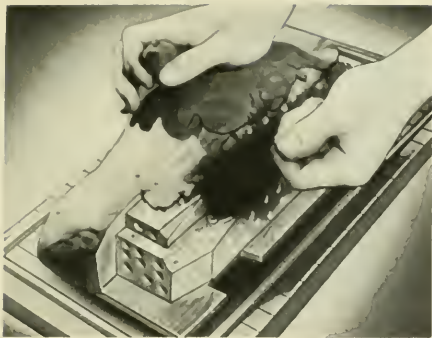
2. Guide strips are straight and should clear model $\frac{1}{2}$ in. all around. Draw station lines on board 1 in. apart, as shown.



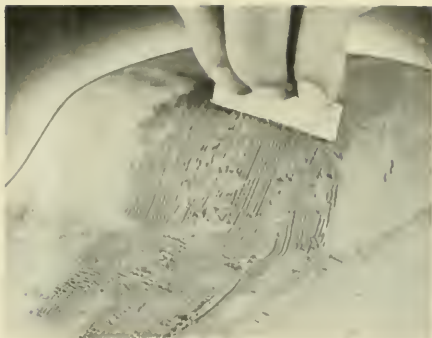
3. Armature on surface board. Guide strips are used in making templates (patterns), explained in photos that follow.



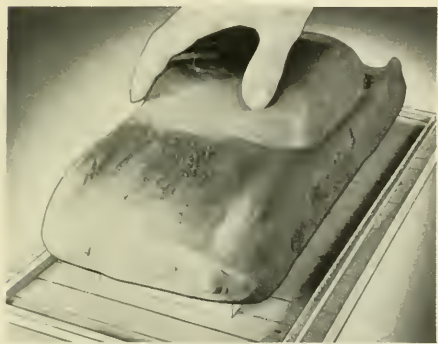
4. Soften clay so it will be easy to "work" by keeping it in hot water in a double boiler—or sieve and warming pan, as shown.



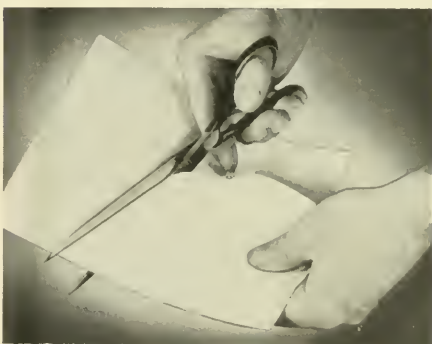
5. Press clay firmly into holes. Rough shape clay by hand. Using your drawings—or your imagination—shape and carve one side (exactly $\frac{1}{2}$ of model) to desired design.



6. Make modeling tools shown in photos. Above, a hacksaw blade used as rough shaper. Photo 14 shows smoother made of scrap rubber; Photo 15, a tool of hardwood.



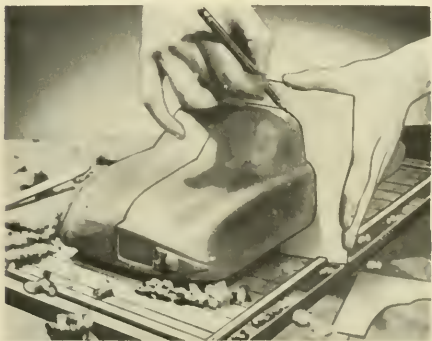
7. Much of the finish smoothing and shaping can be done best with your palm and fingers. Dip hands in water, regularly, for best results.



8. When one side of model is finished, make cardboard templates (patterns) of this side—one at each station line on surface board. Cut cardboard roughly to shape first.



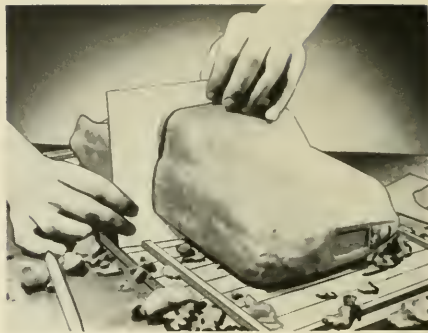
9. Notch out bottom edge of rough template to fit against outer edge of guide strip when template is sunk slightly into clay—in a perpendicular (\perp) position.



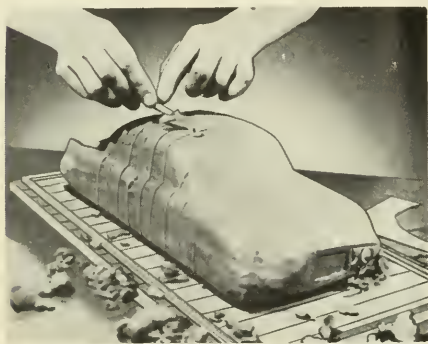
10. Trace exact outline of model on template. Be sure bottom edge of template rests evenly on surface board—and is notched to fit snugly against guide strip.



11. Now, cut out template along your pencil line with scissors or sharp, pointed carving blade. This makes an accurate pattern of one half of model at a given station line.



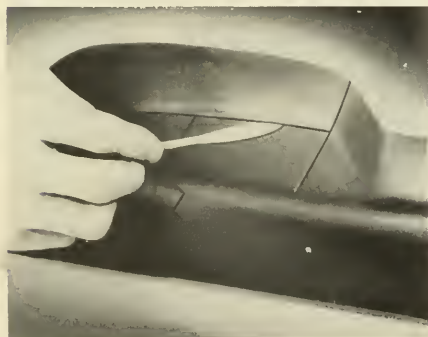
12. With templates, you can make unfinished side of model match finished half. At proper station line, rest each template on surface board. Sink template into clay.



13. Using screwdriver as a carving tool, carefully remove clay between sunken vertical lines made by edges of templates. Smooth surface to exact level of template cuts.



14. Rubber smoothing tool (made from old tire) is excellent for smoothing large, sweeping areas of clay model. Wet surface of clay slightly for best results.




15. For window outlines and other sharply defined details, a spear-shaped tool with rounded point is most effective. Finish all details of clay model as neatly as possible.



16. This illustration shows how you can place cardboard wheels in position as you develop your clay model—to give it a real car look. Model rests on $\frac{3}{4}$ in. block.

• HOW TO MAKE A WOOD MODEL

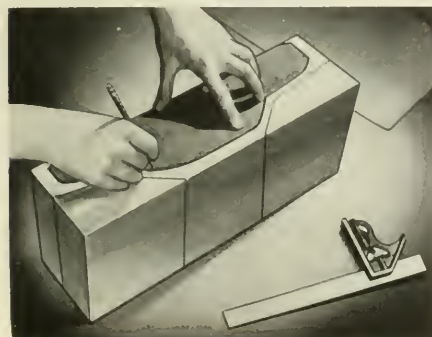
You do not need a *solid* block of wood to make a model car for the Guild competition. *You can make your own block* of the size required using the measurements given on Drawing "A." To do this simply glue together $\frac{3}{4}$ -in., or thicker, boards. Make sure the surfaces are smooth and the grain runs in the same direction before gluing. You don't even need C-clamps. You can use rocks or heavy pieces of metal to hold the boards tightly together while the glue is setting. The types of wood that can be cut and carved most easily are: Balsa, white pine, cypress, basswood, poplar or mahogany. Before you start the rough cutting, square your wood block—that is, make sure the ends and sides all meet at right angles—like this: . You can do the necessary cutting and carving with only a few tools that are easy to buy or borrow: A saw, wood file, chisel, large and small gouges (curved chisels), a hammer, or mallet, and sandpaper. That's about all you need—then, follow the steps shown in the pictures below:



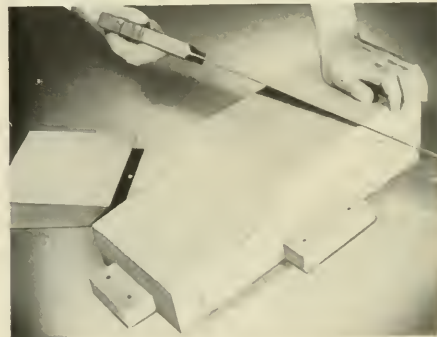
1. Sand boards smooth and glue together. Use casein-base, cold glue, sold at most hardware stores. Make block $6 \times 6\frac{3}{4} \times 17$ in.



2. From your drawings—or clay model—draw and cut out of cardboard an accurate side view pattern of your model.



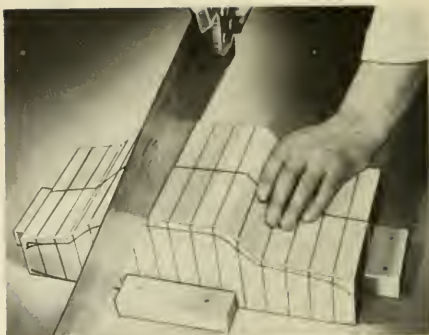
3. Trace this pattern on both sides of your wood block. Also rule off waste areas of block, as shown.



4. Using a common saw, remove the large waste pieces, front and rear, by cutting along your ruled pencil lines.



5. Starting at the bottom of block, rule vertical (\perp) station lines, exactly one inch apart. Join these across top and bottom—also draw centerline around block.



6. Saw top of block down almost to the side-view outlines of your model as traced on block. Make saw-cuts follow station lines drawn across top of the block.



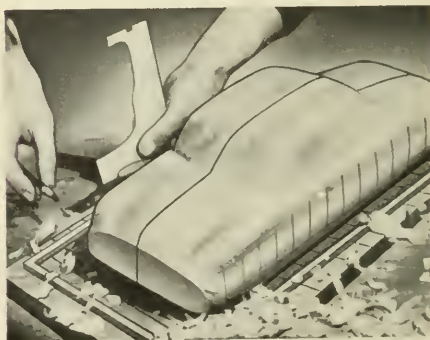
7. Now, with a chisel, carefully shave away wood between saw-cuts. Work chisel across the wood grain. Be careful not to cut below model outlines drawn on block.



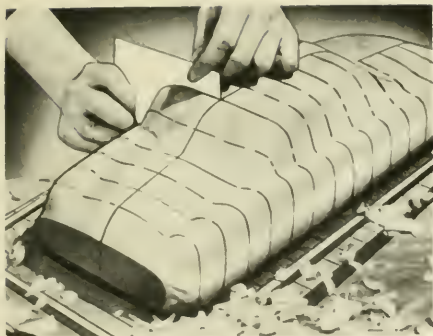
8. Smooth rough-shaped block with plane to get rounded areas worked down toward actual lines of car. Fine work can be done with spokeshave and wood file.



9. Using chisel, gouges, wood file and small knife, work out roughly the major shapes along the sides of wood block, guided by your clay model.



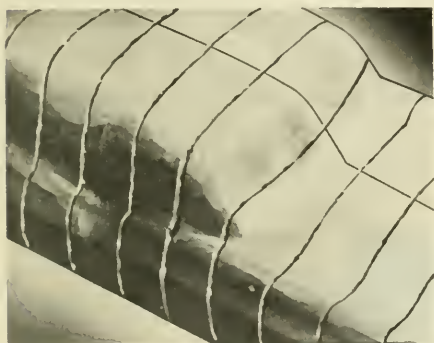
10. Mount wood model on surface board, using it as a guide in restoring station lines and centerline. Rub black crayon on pattern edges of clay-model templates.



11. Put crayoned templates in proper position and rub firmly against model to make crayon mark at high spots. High spots must be trimmed down along all lines on both sides.



12. Use small gouge to level high spots, as shown. Repeat marking and gouging until template fits exactly, top of template at centerline, bottom notched against guide strip.



13. When all station lines have been gouged out, so that all templates fit exactly, the bottoms of gouge cuts will all be in line with the exact surface of your finished model car.



14. Using chisel, carefully remove surplus wood from between gouge lines. This work must be done carefully and neatly to dress wood down to a smooth surface.



15. Put the finishing touches on the surface of your wood model by using a fine file, where necessary, and carefully smoothing the entire surface with sandpaper.



16. Mark window outlines on model, using patterns made from drawings or clay model—then carve out wood. Similar patterns should be made for all surface detail work.

• CASTING A MODEL CAR IN PLASTER

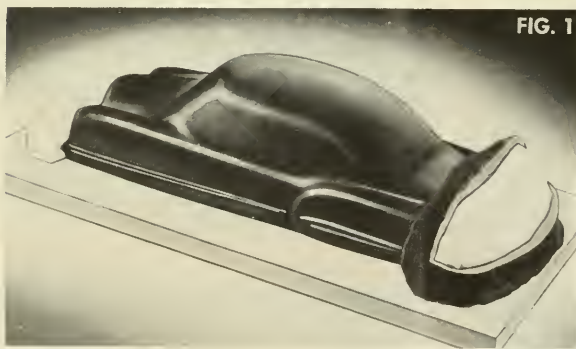
In the design studios of the automobile industry, new designs are worked into plaster models. The following instructions are adapted from the methods used by professional automobile model makers.

In casting your model car in plaster, there are just two major steps: (1) Making a 5-piece plaster mold, using your clay model as a pattern—and (2) Pouring wet plaster into this mold to form an exact duplicate of your clay model.

The only material you will need is about 25 pounds of ordinary molding plaster—which you can buy from almost any builders' supply company. Mix this plaster in water until it is as thick and smooth as heavy cream.

To make the mold, place your clay model on a flat board which has been painted with several coats of shellac (Fig. 1). To prevent the plaster from sticking, coat the board with grease or soap jell.

Here is how you form the mold pieces: Make dams out of flattened rolls of clay and set them up on your clay model to enclose only a section of your clay model. (Fig. 1 shows about the size you should make the front and rear end pieces of the mold. Fig. 2 shows the clay dams in place for making the side sections of the mold. Fig 3 shows the dam



arrangement for making the top section.) Make only one mold section at a time.

After you have set up the clay dams, in each case, use a flat wood paddle to apply wet plaster within the dams and build it up to a thickness of at least $\frac{3}{4}$ in. Let the plaster set before applying the clay dams to make the mold section next to it. Then, coat the edges of the mold sections with shellac and grease (or soap jell) to prevent the adjoining section from sticking.



Be sure to overlap the

mold sections as shown in the illustrations—so that, when you have made all five sections, they will fit together as shown in Fig. 4.

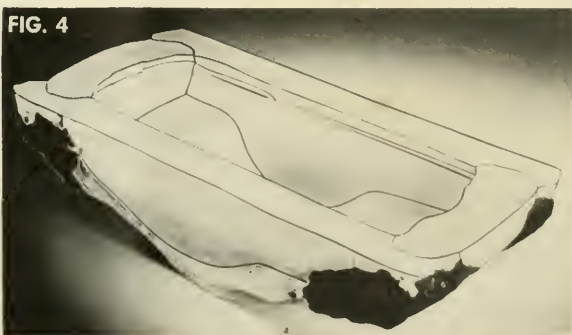
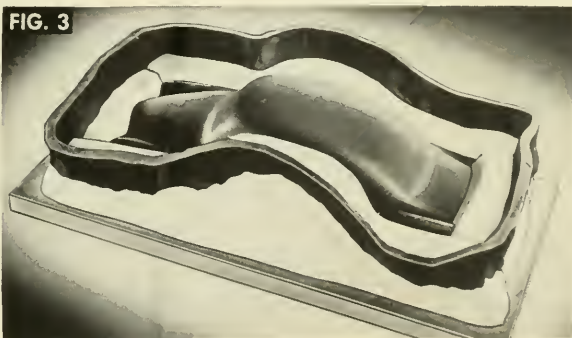
Permit all mold sections to dry for at least one-half hour after they have set. Then carefully remove the sections from your clay model—and put them together as shown in Fig. 4. Bind them all together by applying strips of cheesecloth soaked in thin plaster at the corners where the mold sections meet. (These binders are shown as dark areas in Fig. 4.) Be sure to wet the mold sections thoroughly before attaching the binders—since they will not stick tightly to dry plaster. **YOU NOW HAVE AN EXACT MOLD OF YOUR CLAY MODEL.**

Next, clean and sandpaper the inside of the mold—and fill all pits or holes with clay or plaster. Then apply coats of shellac and grease (or soap jell) to the inside surface of your mold—**AND YOU ARE READY TO POUR THE CASTING OF YOUR MODEL.**

Fill the mold one-third to one-half full of wet plaster mix. Lift the mold and tip it from end to end and side to side—so that the wet mix will flow all around the mold. Do this until the mix begins to stick to all parts of the mold. Set the mold down and apply plaster with the back of your hand—until you have built the casting up to at least $\frac{3}{4}$ -in. thickness at all points.

Place strips of cheesecloth (already cut to fit) against the wet plaster of the casting—then rub wet plaster mix into the cheesecloth. The cheesecloth is used to strengthen your plaster casting.

Permit the plaster casting to dry for at least a half hour—and then carefully remove the mold pieces. Dry out your casting thoroughly—by placing it for three or four days in a dry, well-ventilated room—before you attempt to paint it. Sand the casting thoroughly before you start.



• ATTACHING WHEELS

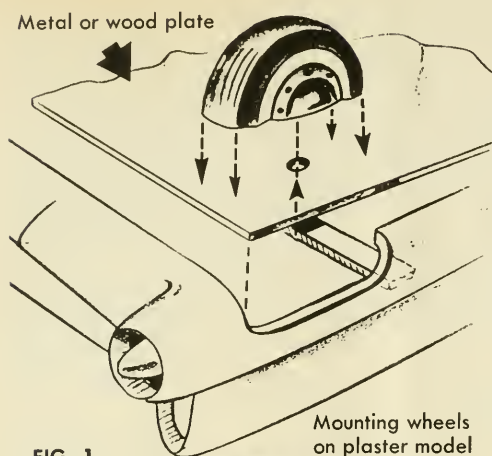


FIG. 1.

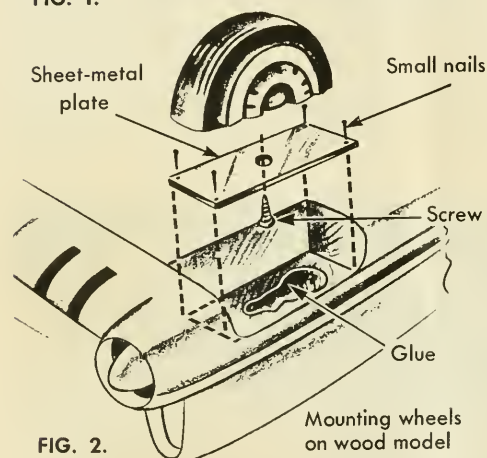


FIG. 2.

Fig. 1—On model cars made of plaster, the wheels can be attached to a wood or steel plate. The plate is then set into the bottom of the model, as shown at the left, and secured in place with screws. If your model car has *exposed* wheels, set the plate in far enough so that it does not show from the sides. Measure wheel and cut to meet requirements of your design.

Fig. 2—On model cars made of wood, wheels can be fastened to individual plates, as shown at the left. These are then set into openings cut into the bottom of the model at the proper locations.

WHEELS SUPPLIED FREE

Making a good set of wheels requires a wood lathe, and most Guildsmen do not have access to a lathe. For this reason, the Guild now supplies sets of wheels, *free of charge*, to Guild members *who can show that their model cars are ready for wheels*. These wheels are made of hardened rubber and are provided with a recess for a hub cap. Hub caps, however, are *not* supplied. You make your own. These wheels may be cut in half for mounting on your model, if your design permits. To get your wheels, mail to Guild headquarters a snapshot *which shows how much work you have done on your model*. If you use half wheels, order two wheels. For full wheels in front and half wheels in rear, order three. Otherwise order four.

• MOLDINGS



LEFT: Cross-sections of various types of moldings

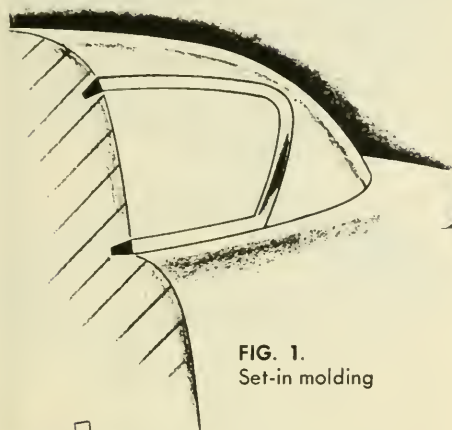


FIG. 1.
Set-in molding

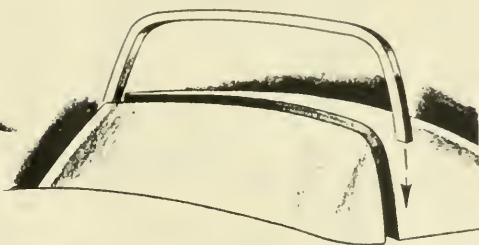


FIG. 2. Set-in type windshield and pillar molding

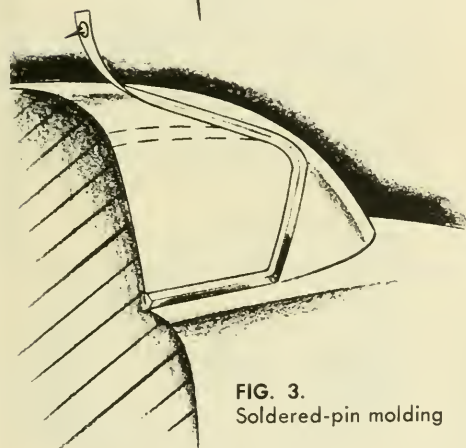


FIG. 3.
Soldered-pin molding

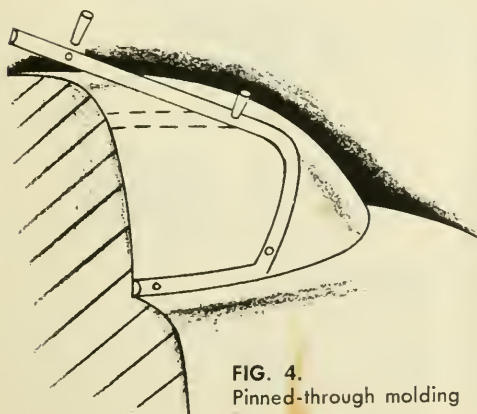


FIG. 4.
Pinned-through molding

Moldings around the windows, or running along the sides of your model car, can be set in or applied, as shown in these illustrations:

Fig. 1 shows method for setting a molding in a groove.

Fig. 2 shows a set-in type of windshield molding in position to be slipped into place.

Fig. 3 shows method of applying molding with fine pins or nails soldered to the underside.

Fig. 4 shows another method of applying molding, using tapered pins driven through drilled holes in molding.

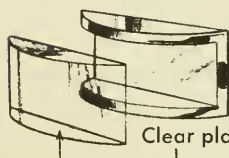
• HEADLIGHTS AND TAIL LIGHTS



Round-type headlight



Round-type headlight with hooded bezel (rim of headlight)



Cut and file from solid aluminum block

Clear plastic

Horizontal-type headlight

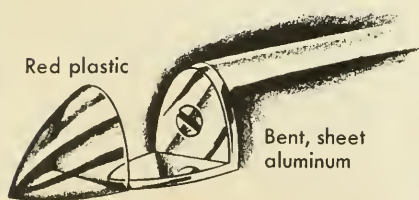
Shown on this page are various methods of making headlights and tail lights. Many materials may be used, among them bar or sheet aluminum, as well as aluminum tubing.

Fig. 1 (below) shows how bar stock may be turned in a lathe.

Fig. 2 shows how flat stock may be utilized.

Fig. 3 shows how to shape aluminum tubing with a sanding block. Tubing is slipped over a dowel placed in an electric drill.

(Lines on headlight lens can be scored on rear surface of plastic.)

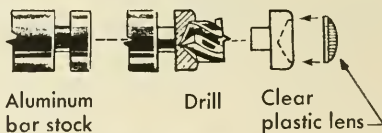


Red plastic

Bent, sheet aluminum

Tail light

FIG. 1



Aluminum bar stock

Drill

Clear plastic lens

FIG. 2

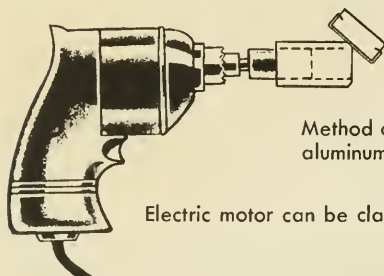


Flat aluminum wrapped around dowel

Sanding block

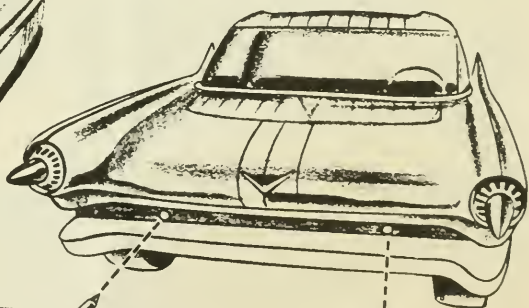
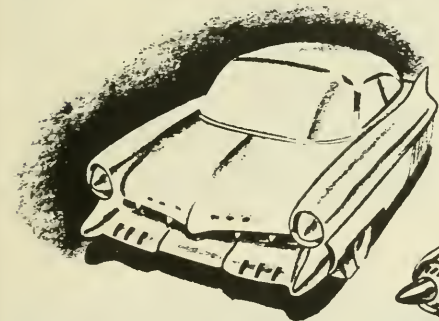
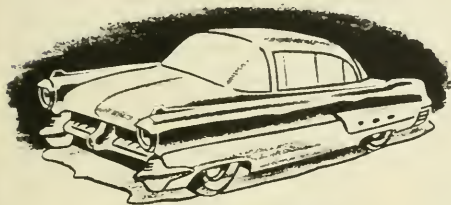
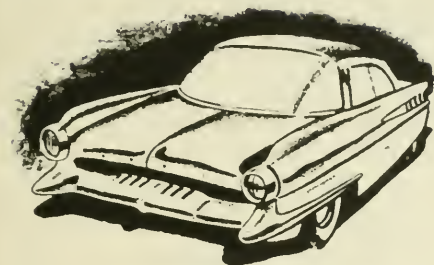
Method of shaping light by using aluminum tubing for bezel

FIG. 3

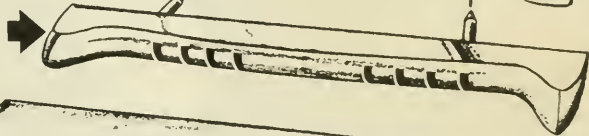


Electric motor can be clamped on bench or in a vise.

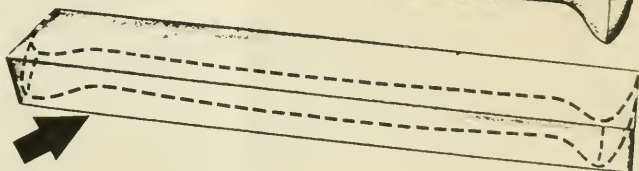
• BUMPERS



Shape and sand smooth.



Start with solid piece.
Cut and file out design.
(For metal, use jeweler's
saw or hacksaw.)



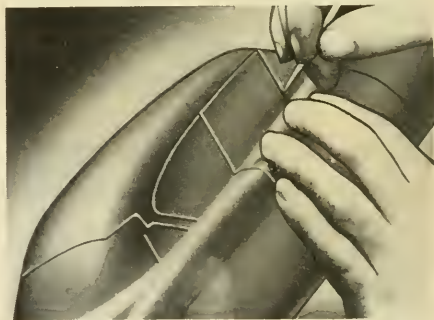
Bumpers can be made from metal, like aluminum bar stock, or from straight-grained hardwood. First, draw the design of your bumper on paper (front view and plan view). Transfer the outline to the wood or metal. The rough shape can then be cut out with a saw. Next, work in all the finer detail and finish by carving (if wood), filing (if metal), and sandpapering. The drawings below show these progressive steps. The front views of models to the left give you some advanced designs of bumpers and grilles to help start your own ideas.

• PAINTING YOUR MODEL CAR

The most important step in putting a gleaming finish on your model is sandpapering the bare surface. **YOU CANNOT HIDE ROUGH SPOTS, PITS OR OTHER FLAWS WITH PAINT.** Fill all low spots with a glaze, surfacing putty or plastic wood. Work over the surface with coarse and fine grades of sandpaper until it is smooth as glass. *Only this kind of surface will take a fine finish.* The first step in painting your model is to apply two or three coats of sealer. Allow each coat to dry over night—the last, several days. Sand last coat to a smooth surface with 180 grit dry sandpaper. Next, apply primer-surfacer—three coats for plaster and hardwoods, five for softer woods. (For balsa use pyroxylin type surfacer that dries with a hard shell—at least 10 coats). Carefully sand each coat. Next, cut in door lines, trunk lines, etc.—or sharpen them if you made them in the surface of your model. *Use lacquer* for the final finish—at least three coats. Sand each coat, except the last, lightly but thoroughly with 360 to 400 grit waterproof sandpaper. **BE SURE NOT TO SAND THE LAST COAT.** Rub down the last coat with a rubbing compound after it is thoroughly dry—then apply hard wax and polish to a brilliant finish.



Carefully sand model between coats. Be sure not to sand last coat of lacquer.



Cut in door lines, trunk lines, etc., before applying finish coats of lacquer.



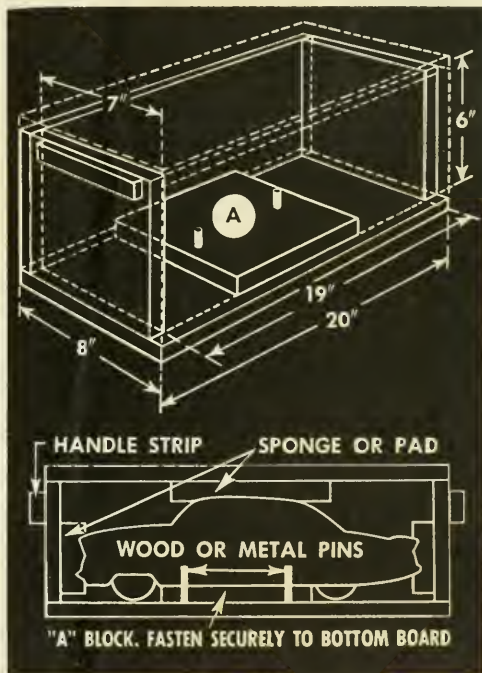
Use insect spray gun to lacquer model. Thin lacquer until it flows freely.



Rub down last lacquer coat with rubbing compound and polish with hard wax.

• SHIPPING YOUR MODEL

A substantial box, with plenty of protective padding, is needed for shipping your model car to the Guild judging point. Such a box can be made of $\frac{1}{2}$ in. solid boards, as shown in the drawing below, or of $\frac{1}{4}$ in. plywood, with $\frac{3}{4}$ in. wood for the framework. Its dimensions will be governed by the overall measurements of your car, but in any case make the container large enough so that there will be at least one inch around the entire model for packing material. A good-sized box, as shown, has inside dimensions of 7 x 6 x 19 in. For packing material you may use felt, paper, cotton batting, or old cloth, all built up to sufficient thickness. As an added precaution, wrap the model in wax paper to prevent the packing material from scratching or adhering to the finish. A piece of sponge rubber or other cushioning material should be attached to the underside of the cover at the point where it will contact the roof. Rubber can also be attached at either end of the box and along the sides. The top of the container should be fastened with screws rather than nails. Since the wheels will not withstand a severe jolt, you should keep them off the bottom of the container by fitting a block of wood under the car body. If you make a solid model, you may also drill two holes in the bottom of it and insert dowels, as shown. These precautions will help keep the model from shifting during its journey. *Do not ship your model until you receive special shipping instructions from the Craftsman's Guild.*



If you desire any further advice on building your model, write to:—

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